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ABSTRACT

The problems involved in measuring psychotherapeutic effectiveness must be addressed first by developing specific criteria for measuring behavior change. These criteria can be established when a clear-cut distinction between acceptable and unacceptable behavior is well defined. To illustrate the potential use of regression methodology in measuring therapeutic effectiveness, two groups of high school students, i.e., drug users (N=40) and non-drug users (N=40), completed a data questionnaire and the Sixteen Personality Factor Questionnaire (16PF), Form A, to determine whether users and non-users differed on basic personality characteristics. Analyses of results revealed that nine personality factors differentiated the two groups. A multiple regression technique applied to these statistical differences established a prediction equation accounting for 60% of the criterion variance while identifying potential drug users. The results indicate that regression techniques can establish a data base for measuring therapeutic effectiveness when clear-cut distinctions between acceptable and unacceptable behavior are defined. (Author/MCF)

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REGRESSION TECHNIQUES FOR THE MEASUREMENT OF PSYCHOTHERAPEUTIC CHANGE

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Running Head:

Regression Techniques / Therapeutic Change

The difficulty involved in researching therapeutic effectiveness has long existed as one of the most pressing issues in research and measurement. Some researchers such as Meehl (1955) feel that the use of control and experimental groups with pretest-posttest evaluations and follow-up studies are appropriate. Others such as Eysenck (1961) feel that there must be observation and independent assessment by the therapist, the family and/or friends; and that there must be measures of physiological change, social change, and personality change. Still other researchers such as Paul (1966) and DiLoreto (1971) have perhaps prematurely attempted to do comparisons of various schools of psychotherapy, thinking as they did so that they could find the "best" approach to the evaluation of behavior change.

Fiske and his fellow researchers (1970) have warned that the difficulty in evaluating therapy is concerned with,

> . . . a treatment modality which has not been defined, the effects of which are presumed to require a long period of treatment, and the evaluation of which demands long term follow-up. Furthermore, the treatment procedures are designed to modify conditions where the spontaneous recovery rate is considerable and the means of evaluating recovery controversial.

Although there are a number of ways a researcher might approach such a problem, it seems that the first step toward evaluation must concern itself with specific criteria against which behavior change can be measured. To develop such criteria it also seems essential to explore specific types of problems which are now being served by psychotherapists and in which clear-cut distinctions between acceptable and

unacceptable behavior seems rather well defined. Within the broad spectrum covered by the measurement of change resulting from psychotherapy there appear to be two areas of chemical dependency in which such clear-cut distinctions might be possible, one is in the area of alcoholism where there seems to be a potential dichotomy between those who use alcohol and those who do not. The second seems to be in the area of "other-drug dependency" where you have those who use drugs as compared with those who do not, i.e., those who use such things as hallucinogens, amphetamines, and phenothiazines.

Rationale

Reviewing the level of data measurement and other evidence relevant to this problem seems, at first, to suggest the use of a discriminant function technique as a statistical procedure. The appropriateness of this technique is well summarized in a review by Huberty (1975). Yet, problems with interpretability of the discriminant function are also contained in the literature. Lunneborg & Lunneborg (1978) explore why discriminant function analyses are not easily interpretable and suggest a rotation of axes to facilitate interpretability.

> The counseling use of the results of discriminant function analysis however, depend very much upon their interpretability . . . Counseling information, to be credible, must respond not to the simplistic demand "Tell me what to do", but the more searching questions of "What distinguishes pharmacists' interest from those of laboratory technicians" and "Why am I more like a sociology student"? (p. 738).

Lunneborg & Lunneborg (1978) further contend that to help people find

answers to their inquiries the counselor or therapist needs measures which make psychological sense. Thus it would seem that an approach to this problem would have to have a data base or base line understanding which will provide a continuous scale along which movement (as a result of behavior adjustment) can be observed. It is maintained that the scale should be the result of measurements on multiple dimensions so as to reduce the unreliability aspects of using a single determinant to analyze complex phenomena. The literature contains uses of this concept in principle. For example, Blixt (1980) used multiple regression and multiple discriminant function to predict academic rank(an ordinal measure). In his sample of 103 faculty members it was found that the regression technique was better able to predict the ordinal variable on the cross-validation sample than was the discriminant function. The regression correctly placed 70.59% of the people while the discriminant function correctly placed 60.75%.

In order to deal with some of the problems regarding interpretability of research results, a multiple regression technique was eventually selected to attempt the measurement of therapeutic change. Thus, one of the principle purposes of the study was to illustrate the use of regression methodology in a research environment and to suggest ways wherein research investigations into the measurement of therapeutic changes could be improved. Moreover, since a development for the equivalence of multiple discriminant function and multiple linear regression for the two group case in Tatsuoka (1970) suggests

use of the regression technique for the purpose of discriminating between two groups, it was given first priority in this discussion. Evidence suggests that multiple regression techniques would conveniently allow the employment of a criterion continuum for the prediction of drug use, and that the methodology incorporated would then serve to establish a data base by which therapeutic change could be documented. That is, it appeared that through a multiple regression technique, it would be possible to look at prescriptive therapy as well as a patient's commitment to change. It also seemed essential for such a study to concern itself with two major issues:

(a) what statistical differences, if any, could be determined by a comparative analysis of personality characteristics between users and nonusers of drugs, and

(b) how such differences could be used to assist therapists in terms of developing more effective treatment procedures.

It was hypothesized that by differentiating users (U) and nonusers (NU), a baseline concept of behavior could be established which, if utilized within the realm of psychotherapy could determine what movement, if any, a person was making toward use or nonuse. Second, it seemed that if such a baseline concept was established it might serve as one criterion against which effectiveness in therapy could be assessed.

Hypothesis

The hypothesis to be tested was: H_0: $M_U = M_{NU}$

Method

To find evidence bearing directly upon this problem, two groups

of young adults were matched on the basis of sex, age, and social position. Drug users were identified through work previously done in conjunction with a drug abuse center. Nonusers were identified through the cooperative efforts of drug educators.

The criteria for the selection of users required that they:

(a) have records of consistent use for no less than four months,

(b) have records of consistent use for no less than four weeks preceding this study,

(c) have no record of treatment, and

(d) be of high school age.

The forty youngsters who met this criteria were matched with forty nonusers. The nonusers were selected on the basis of a single differentiating criterion, i.e., that they had no previous consistent involvement with amphetamines, hallucinogens, or phenothiazines. Methods of validating the nonusers status included an indepth investigation involving students, teachers, counselors, parents, ministers, and school administrators.

To determine the social position of participants, the Hollingshead Two Factor Index of Social Position was used. A comparison of the two groups can be seen in Table 1.

Insert Table 1 about here

Research Instruments

Since the two groups seemed reasonably compatible at this point, participants were asked to complete a Data Questionnaire and the Sixteen Personality Factor Questionnaire, (16PF), Form A.

The Data Questionnaire was adapted, in part, from the rather comprehensive intake form used by the Mississippi Gulf Coast Drug Abuse Center. Primarily, its design serves to gain basic biographic and drug use information. Its basic purpose in this study was for an indepth analysis of drug users. The assumption was that if personality differences were not discernible between the groups, that consistency of use and/or type of drug use might lead itself to differential comparisons.

The Sixteen Personality Factor Questionnaire, Form A, was used to determine whether or not users and nonusers could be differentiated on the basis of personality characteristics. Raymond Cattell designed the instrument and much of what the instrument is capable of doing can be found in the Handbook for the Sixteen Personality Factor Questionnaire, published by the Institute for Personality and Ability Testing located in Champaign, Illinois.

All participants completed the instruments at matched time intervals. Packets containing the necessary materials and coded answer sheets were provided for both groups. Adminstration was done at the convenience of participants both on an individual and/or

group basis. Regulations governing the implementation of this study were established and maintained by the Deputy Director of the Drug Center.

Statistical Implications

Once the 16PF data was collected, raw scores for both groups were converted to stens. Group comparisons were then made through a two step design:

(a) Univariate F tests were used to test for significance between drug users and nonusers on each of the 16 personality factors.

(b) A Multiple regression technique was used to determine movement and to establish a baseline of behavior from which the effectiveness of treatment techniques became discernible.

The distribution of drugs as used by participants can be seen in Table 2.

Insert Table 2 about here

Results

Results of the 16PF comparisons indicate that nine personality factors differentiated between users and nonusers:

Factor		Definitive Polarity
B	-	Less Intelligent - More Intelligent
*E	-	Humble - Assertive
G	-	Expedient - Conscientious
*L	-	Trusting - Suspicious
*M	-	Practical - Imaginative

*O	-	Self-assured - Apprehensive
*Q_1	-	Conservative - Experimenting
Q_3	-	Undisciplined - Controlled
*Q_4	-	Relaxed - Tense

*Users were higher than nonusers

(See Table 3)

Insert Table 3 about here

Recognizing that these nine factors could become the root for a baseline concept in therapeutic effectiveness, the research continued using a multiple regression technique to construct a prediction equation which accounted for over 60 per cent of the criterion variance while identifying potential drug users.

Utilizing "Y" as the predicted criterion score (where 1 = USER, 0 = NONUSER), X as the sten score for personality prediction, and R_c as the regression constant, the resulting equation was:

$$Y = (.043)(X) + (-.127)(X) + (.041)(X) + (.101)(X) + (-.003)(X) + (-.0725)(X) + (-.007)(X) + (.017)(X) + (-.002)(X) + (-.002)(X) + (.019)(X) + (.047)(X) + (.019)(X) + (.033)(X) + (.013)(X) + (-.048)(X) + (-.041\ R_c)$$

As an example of how to apply the formula, suppose that a therapist is going to work with a group of young adults and wants to know who the potential drug users are before beginning therapy. The therapist can screen his or her clients by using the 16PF in the following way: The therapist first takes the raw scores from the 16PF and converts them into stens by using the appropriate norm table. Each personality factor is listed along with the respective sten score. Suppose, for example, that the therapist had a 16PF personality profile which looked like this:

A = 8, B = 4, C = 7, E = 9, F = 5, G = 3, H = 5,
I = 4, L = 6, M = 7, N = 4, O = 2, Q_1 = 8, Q_2 = 9,
Q_3 = 4, Q_4 = 3. (See Table 4 for respective Beta Weights)

Insert Table 4 about here

Entering Table 5, one can now obtain the products of the sten score and their appropriate B Weights. For example, the therapist locates Factor A on the left side of Table 5 and follows the Factor A row into the Table until he or she reaches the column under Sten 8 to find the value 0.344. This now is the product of the B weight (.043) times the Sten of 8 and thus becomes the contribution of A in the prediction of Y. Similarly, the therapist continues this process computing the products for each of the predictors. Once computed, he or she places them into the Y equation and comes up with the following

extrapolated equation:

Insert Table 5 about here

(.344) + (-.506) + (.288) + (.909) + (-.017) +
(-.218) + (-.035) + (.068) + (-.011) + (-.017) +
(.075) + (.094) + (149) + (.293) + (.040) +
(-.143) + (-.041) = Y

The "-.041" is the regression constant which must be added into each equation since the B's are raw score weights. In the example given, adding the positive numbers yields a sum of 2.260 while adding the negative numbers yields a result of -.988. The difference between these two numbers is 1.272. This is the predicted criterion score.

To establish the significance of such a score, the therapist goes to Table 6 and compares this score of 1.272 with those on the Table. The comparison, in this case, reveals that the score falls in the high range of predicted scores obtained by users (A high score indicates a proclivity toward drug use; a low score, a predisposition toward nonuse).

Insert Table 6 about here

After several months of therapy, the therapist can once again measure to determine the effectiveness of his or her efforts. If the predicted score after therapy is significantly lower, then the therapist has some idea of how his or her client is responding to therapy.

Discussion

There are three basic advantages to the use of regression techniques in therapy. First, the results of using this approach defines where a client is when therapy is initiated. Second, it provides both the therapist and the client with an understanding of what direction the client is taking and to what extent the client has moved. Third, for those who feel that behavior change is not necessarily the result of therapy (Gross, 1978), one can easily apply appropriate controls to determine whether or not experimental groups move while control groups remain constant. The criteria by which change is measured is pragmatic and definitive thus giving the therapist a data base from which to evaluate his or her own effectiveness.

Still another advantage of this approach is that it can also be applied to the area of drug education. It will just as easily measure feelings about drug use after exposure to drug education programs as it will the effectiveness of change through therapy.

TABLE 1

ANALYSIS OF VARIANCE FOR THE AGE AND SOCIAL POSITION OF USERS AND NONUSERS

	U Group N = 40	N Group N = 40	F-ratio	Probability
Mean Age	16.7750	16.9750	.942	.6639
Males	22	22		
Females	18	18		
Mean Social Position	2.7000	2.6500	.037	.8426

TABLE 2

DISTRIBUTION OF USER GROUP DRUG USE

Drugs	Number of Male Users	Percent of Males Using Each Drug	Number of Female Users	Percent of Females Using Each Drug	Total Number of Users	Percent of User Group Using Each Drug
Heroin			1*	5.55	1	2.50
Other Opiates	1*	4.54			1	2.50
Cocaine	5	22.72	5	27.77	10	25.00
Illegal Methadone	0	0.00	0	0.00	0	0.00
Barbiturates	17	77.27	11	61.11	28	70.00
Amphetamines	9	40.90	13	72.22	22	55.00
Hallucinogens	11	50.00	7	38.88	18	45.00
Inhalants	4	18.18	1	5.55	5	12.50
Marijuana	22	100.00	18	100.00	40	100.00
Alcohol/other	14	63.63	9	50.00	23	57.50

*The brief experimenting these young adults had done with opiates was insufficient to disqualify them as users.

TABLE : 3

CORRELATION OF THE 16 PERSONALITY FACTORS
WITH THE CRITERION

Factor	Correlation Coefficient	Factor	Correlation Coefficient
B	-.4923*	Q_4	.2199*
G	-.4701*	C	-.1796
E	.4333*	Q_2	.1769
Q_1	.4162*	I	.0959
O	.3797*	H	.0666
M	.3040*	N	-.0654
Q_3	-.2936*	A	-.0416
L	.2682*	F	.0407

* Factors which significantly differentiated between users and nonusers.

TABLE 4

WEIGHTS TO BE INSERTED INTO THE REGRESSION EQUATION FOR EACH OF THE SIXTEEN PREDICTORS

Factor	Beta Weight	B Weight
A	.1552	.0431
B	-.5077	-.1265
C	.1779	.0412
E	.4201	.1011
F	-.0121	-.0033
G	-.3079	-.0725
H	.0289	-.0070
I	.0749	.0169
L	-.0066	-.0018
M	-.0091	-.0024
N	.0646	.0188
O	.2231	.0471
Q_1	.0780	.0186
Q_2	.1338	.0326
Q_3	.0538	.0132
Q_4	-.2212	-.0475

Note: Regression Constant = -.0405

TABLE 5

PRODUCTS OF FACTOR STENS AND THEIR RESPECTIVE B WEIGHTS

	STENS									
Factors	1	2	3	4	5	6	7	8	9	10
A	.043	.086	.129	.172	.215	.258	.301	.344	.387	.431
B	-.127	-.253	-.380	-.506	-.633	-.759	-.886	-1.012	-1.139	-1.265
C	.041	.082	.124	.155	.206	.247	.288	.330	.3708	.412
E	.101	.202	.303	.404	.505	.606	.707	.808	.909	1.011
F	-.003	-.006	-.009	-.012	-.017	-.019	-.023	-.026	-.030	-.033
G	-.073	-.145	-.218	-.290	-.363	-.435	-.508	-.580	-.653	-.725
H	-.007	-.014	-.021	-.028	-.035	-.042	-.049	-.056	-.063	-.070
I	.017	.034	.051	.068	.085	.101	.118	.135	.152	.169
L	-.002	-.004	-.006	-.008	-.009	-.011	-.013	-.014	-.016	-.018
M	-.002	-.005	-.007	-.001	-.012	-.014	-.017	-.019	-.022	-.024
N	.019	.038	.056	.075	.094	.113	.132	.150	.169	.188
O	.047	.094	.141	.188	.236	.283	.330	.377	.424	.471
Q_1	.019	.037	.056	.074	.093	.112	.130	.149	.167	.186
Q_2	.033	.065	.098	.130	.163	.196	.228	.261	.293	.326
Q_3	.013	.026	.040	.053	.066	.079	.092	.106	.119	.132
Q_4	-.048	-.095	-.143	-.190	-.238	-.285	-.333	-.380	-.428	-.475

Regression Constant = -.041

TABLE 6

RANKED DISTRIBUTION OF PREDICTED SCORES FOR USERS AND NONUSERS THAT ARE OBTAINED BY USING ALL 16 PREDICTORS

1.2601	.7899	.4896**	.1840
1.2167	.7855	.4710**	.1479
1.1057	.7755	.4547**	.1435
1.1023	.7725	.4340**	.1213
1.0815	.7712	.4298	.1093
1.0513	.7633	.4232**	.1009
1.0295	.7586	.4188	.0819
.9792	.7478	.4010	.0770
.9584	.7423	.3920	.0727
.9501	.7267*	.3886	.0699
.9480	.7210	.3846**	.0607
.9428	.6313	.3844	.0509
.9325	.6290*	.3836	-.0390
.8992	.5834*	.3688	-.0536
.8929	.5712*	.2726	-.0683
.8754	.5694*	.2502	-.2411
.8741	.5644	.2430	-.2544
.8648	.5526	.2183	-.2755
.8518	.5368	.2077	-.2872
.8270	.5150*	.1954	-.3628

*Nonusers whose scores are in the range of predicted use.

**Users whose scores are in the range of predicted nonuse.

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